

IC07 Res'd PCT/PTO 20 APR 2001

ATTORNEY'S DOCKET NO
H 3516 PCT/US

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (if known, see 37 CFR 1.52)

097807948

INTERNATIONAL APPLICATION NO.
PCT/EP99/07683

INTERNATIONAL FILING DATE
October 13, 1999

PRIORITY DATE CLAIMED
October 22, 1998

TITLE OF INVENTION

HOT-MELT ADHESIVE COMPONENT LAYERS FOR SMART CARDS

APPLICANT(S) FOR DO/EO/US

Paul Ranft, Liane Meuten, Juergen Gruetzner, Uwe Kolb

Applicant herewith submits to the United States Designated/Elected Office (EO/DO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39 (1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). UNEXECUTED
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

Drawing (1 sheet)

"Express Mail" mailing label number EL615776083US

U.S. Application No. (If known, see 37 CFR 1.51) **09/807948**INTERNATIONAL APPLICATION NO.
PCT/EP99/07683ATTORNEY'S DOCKET NUMBER
H 3516 PCT/US

17. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....**\$1000.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....**\$860.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO**\$710.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$690.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4).....**\$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT

=

\$ 860

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date 37 CFR 1.492(e).

\$ 0

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total Claims	1 - 20 =	0	0 X \$18.00
Independent Claims	1 - 3 =	0	0 X \$80.00
Multiple dependent claims (s)(if applicable)	0		+ \$270.00

\$ 0

\$ 0

\$ 0

TOTAL OF ABOVE CALCULATIONS

=

\$ 860

Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$ 0

SUBTOTAL

=

\$ 860

Processing fee of **\$130.00** for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).

+

\$ 0

TOTAL NATIONAL FEE

=

\$ 860

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

+

\$ 0

TOTAL FEES ENCLOSED

=

\$ 860

Amount to be:
refunded:

\$-----

charged:

\$ 860.00

a. ☐ A check in the amount of \$_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 01-1250 in the amount of \$ 860.00 to cover the above fees. A triplicate copy of this sheet is enclosed. Order No. 01-0316.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-1250. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: Henkel Corporation, Law Dept.
2500 Renaissance Blvd., Suite 200
Gulph Mills, PA 19406

SIGNATURE:

Kimberly R. Hild

Kimberly R. Hild
NAME ATTORNEY FOR APPLICANT
39,224
REGISTRATION NUMBER

09/807948

Express Mail Label No. EL615776083US

JC08 Rec'd PCT/PTO 20 APR 2001

PATENT
Docket H 3516 PCT/US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re: PCT/EP99/07683

International Filing Date: October 13, 1999
Priority Date Claimed: October 22, 1998
Applicant: Ranft et al.
Title: HOT-MELT ADHESIVE COMPONENT LAYERS FOR SMART CARDS
Applicants' Reference: H 3516 PCT/US

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box PCT
Washington, DC 20231

Attn: DO/EO/US

Sir:

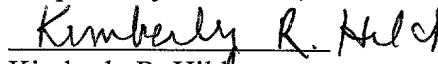
Before examining this application, please enter these amendments:

IN THE CLAIMS:

Please cancel claims 2 to 6 without prejudice.

Should any fees be deemed necessary to enter this amendment, please charge them to Deposit Account No. 01-1250.

Respectfully submitted,


Kimberly R. Hild
Reg. No. 39,224
Attorney for Applicants
(610) 278-4964

Date: April 20, 2001
Henkel Corporation Patent Department
2500 Renaissance Blvd., Suite 200
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KRH/bj

13 Rec'd PCT/PTO 27 NOV 2001
09/807948

PATENT
Docket No. H 3516 PCT/US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Ranft et al.,

International Application No. PCT/EP99/07683

International Filing Date: October 13, 1999

Serial No. 09/807,948

Examiner: To be assigned

Filed: To be assigned

Art Unit: To be assigned

Title: HOT-MELT ADHESIVE COMPONENT LAYERS FOR
SMART CARDS

"Express Mail Post Office to Addressee" service mailing label number EL540669185US

SUPPLEMENTAL PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, DC 20231

Attn: DO/EO/US

Sir:

Prior to examining this application, please amend the application as follows:

In the Specification (Using the English Translation):

On page 1 of the English translation, on a separate line between the title and line 1, please insert the following header and paragraph on consecutive lines as shown below:

-- CROSS REFERENCE TO RELATED APPLICATIONS

This application is a national stage application under 35 U.S.C. § 371 of international application PCT/EP99/07683 filed on October 13, 1999, the international application not being published in English. This application also claims priority under 35 U.S.C. §119 to DE 198 48 712.6, filed on October 22, 1998. --

On page 1, on a separate line immediately after the above inserted paragraph and before line 1, please insert the following header:

-- FIELD OF THE INVENTION --.

On page 1, on a separate line between lines 4 and 5, please insert the following header:

-- BACKGROUND OF THE INVENTION -- .

On page 6, on a separate line before line 1, please insert the following header:

-- SUMMARY OF THE INVENTION --.

On page 6, on a separate line between lines 8 and 9 please insert the following header and paragraph on consecutive lines:

-- BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a plan view of a bottom part of an injection mold.

Fig. 2 shows a cross-sectional view of the upper part of the injection mold of Fig. 1 taken at line A-B of Fig. 1.

Fig. 3 shows a detailed view of Fig. 2 at the circled region labeled C in Fig. 2. --

On page 6, on a separate line immediately following the above inserted paragraph and before line 9, please insert the following header:

-- DETAILED DESCRIPTION OF THE INVENTION --.

On a separate page, after page 13, please insert the enclosed Abstract of the Disclosure.

In the Claims

Please cancel Claim 1, without prejudice.

Please add the following new claims:

-- 7. (NEW) A process for producing a card body comprising forming a component layer comprising one or more electronic circuits or transponders using a thermoplastic hot-melt adhesive, wherein the hot-melt adhesive has a processing viscosity ranging from 100 mPa·s to 100,000 mPa·s and at least partially encapsulates the electronic circuits or transponders.

8. (NEW) The process of claim 7 wherein the forming of the component layer is carried out in an injection molding process at an injection molding pressure ranging from 1 bar to 50 bar and an injection molding temperature ranging from 80°C to 250°C.

9. (NEW) The process of claim 8 wherein the injection molding temperature ranges from 100°C to 230°C.

10. (NEW) The process of claim 9 wherein the injection molding pressure ranges from 10 bar to 30 bar.

11. (NEW) The process of claim 8 wherein the forming comprises providing an electronic circuit on a support film and injecting the hot-melt adhesive onto the electronic circuit in an injection mold.

12. (NEW) The process of claim 8 wherein the forming comprises applying a film of the hot-melt adhesive in an injection mold, placing the electronic component on the film, and injecting a second amount of the hot-melt adhesive onto the electronic component to encapsulate the electronic component in the hot-melt adhesive.

13. (NEW) The process of claim 8, wherein the hot-melt adhesive comprises a polyamide, polyurethane, polyester, atactic polypropylene, ethylene-vinyl acetate copolymers, or low molecular mass polyethylene copolymers, or combinations thereof.

14. (NEW) A transponder or card body produced by the process of claim 8.

15. (NEW) The transponder or card body of claim 14 wherein the card body is a smart card.

16. (NEW) The process of claim 7, wherein the hot-melt adhesive comprises a polyamide, polyurethane, polyester, atactic polypropylene, ethylene-vinyl acetate copolymers, or low molecular mass polyethylene copolymers, or combinations thereof.

17. (NEW) A transponder or card body produced by the process of claim 7.

18. (NEW) The transponder or card body of claim 17 wherein the card body is a smart card. --

REMARKS

Applicants respectfully request the Examiner to enter the above amendments prior to the examination of this application.

Status of Claims

Claims 7 to 18 will be pending after entry of the present amendment. Claim 1 is being canceled without prejudice.

Amendment

The specification is being amended to insert section headers and an abstract of the disclosure in accordance with 37 CFR §1.77 to better conform with US patent practice. The specification is also being amended to insert a cross-reference to related applications in accordance with 37 CFR §1.78 and to claim priority to those applications listed therein.

New Claims 7 to 18 replace original Claims 1 to 6, and are being presented to better conform with US patent practice. These new claims are supported by the specification for example as shown in the Table below (cites to the specification are for the English translation):

Claim	Support in Specification
7	page 6, lines 1 to 15, page 9, lines 10 to 30, page 10, lines 6 to 10, original claim 2, page 12, lines 13 to 18
8, 9, 10	page 6, lines 9 to 22
11	page 9, lines 10 to 24
12	page 9, line 25 to page 10, line 5
13, 16	page 8, lines 20 to 29
14, 15, 17, 18	page 12, lines 13 to 18

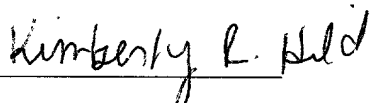
No new matter is added by the new claims or amendments to the specification.

Docket No. H3516 PCT/US
PCT/EP99/07683

CONCLUSION

The Assistant Commissioner is authorized to charge any deficiency in the required fee or to credit any overpayment to Deposit Account 01-1250 in connection with this amendment.

Respectfully submitted,



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Abstract of the Disclosure

The present invention relates to process for producing a card body, such as a smart card or transponder. The process uses a thermoplastic hot-melt adhesive having a processing viscosity ranging from 100 mPa·s to 100,000 mPa·s to form a card body component layer containing an electronic circuit (e.g., chip) or transponder.

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PCT/EP99/07683

JC08 Rec'd PCT/PTO 20 APR 2001

Hot-Melt Adhesive Component Layers for Smart Cards

The invention relates to a multilayer composite, to a process for producing it, and to the use of thermoplastic hot-melt adhesives for producing said composite.

- 5 The present invention is concerned predominantly but not exclusively with the production of what are known as smart cards. By a smart card is meant a generally multilayer article in the form of a plastic card, which is commonly provided with information and/or advertising imprints and/or with security features, such as a photo of the cardholder, a magnetic strip, an identification symbol in the form of a hologram or the like. This smart card commonly consists of a plastic card laminated on one or both sides.
- 10 Embedded in the body of the smart card is what is known as a module, whose key constituent is an electronic circuit (chip). This chip may be seated on a support plate which in one particular embodiment is provided with a plurality of electrically conductive surface segments. This segmented electrical contact area is accessible from the outside so that information, e.g. data and identification features, may be exchanged by way of these contacts with external computers and/or control equipment.
- 15 Newer types of card include an antenna connected electrically to the chip within the card body, so that by way of this antenna there is the facility both for contactless electronic exchange of information and for contactless supply of energy to the chip in the card body. Smart cards of this kind are used or envisaged as telephone cards, authorization cards for mobile communication devices, check cards in monetary
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- 25
- 30

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transactions, proofs of authorization for health insurance organizations, driver's licenses, train tickets, and bus tickets. The user inserts the contactless smart card into a card reader or moves it at a distance past the reader, which communicates with the electronic circuit in the smart card by way of a corresponding antenna facility. In this way it is possible, for example, in the case of a telephone card or a check card or a rail ticket, to check the presence of funds, to ascertain an identity, or to perform some other data exchange.

Production processes for the contactless smart cards are known in principle. For instance, WO-A-98/09252 describes a multistage production process. In that process, the so-called component layer or card body is provided with openings, depressions or similar cavities, after which the electronic components to be disposed in the card body are inserted into these cavities, then the card body is coated with an adhesive in such a way that the cavities are filled and the adhesive forms a substantially planar surface. Subsequently, a cover film is applied to the surface of the adhesive, which has not yet set or fully cured and which is therefore still plastically deformable. The face of the cover film remote from the card body is then held fixed on a shaping surface in such a way and for sufficient time, during the curing of the adhesive, that the external contour of the cover film and thus the external contour of the finished smart card corresponds to the contour of the shaping surface. The adhesive proposed is a cold-curable adhesive, in particular an epoxy adhesive. In order to prevent shrinkage of this adhesive, it must be filled with a filling material such as glass, quartz or the like.

This production process comprises many worksteps and is time-consuming and therefore very costly.

EP-A-0 692 770 describes a process in which the chip and the antenna are introduced into the cavity of an injection mold, after which a thermoplastic material is injected into this mold, where appropriate in a plurality of worksteps. The thermoplastic material proposed comprises typical injection molding materials such as PVC, ABS (acrylonitrile-butadiene-styrene terpolymer), polyethylene terephthalate (PET), polycarbonate (PC) or polyamide (PA). Such injection molding materials require very high temperatures during processing, and high pressures of, for example, 700 kg/cm². Such high pressures and temperatures are, however, very poorly suited to the sensitive electronic circuits to be embedded, with the consequence that these circuits often suffer damage.

EP-A-0 709 804 proposes, in a multistage injection molding process, first inserting a plastic disk into the injection mold, the antenna being placed on said disk. Subsequently, a liquid polymer material (mention is made specifically of ABS, PC, PET, polyamide or reactive resins curable at higher temperatures such as polyurethane, epoxy-phenolic resins) is spread over the surface of the antenna, with the antenna connections being left exposed. Subsequently, a plastic film which closes the hole in the card is placed over the antenna. This plastic film has an indentation into which the electronic chip is accommodated in such a way that it is in electrical contact with the antenna contacts. This procedure also necessitates high temperatures and high pressures for the injection molding steps; furthermore, additional worksteps are necessary in order to insert the electric circuit into the card

body, to fix it and to connect it electrically to the antenna.

JP-A-08 276 459 describes a production process for contactless smart cards in which the component support comprises a glass fiber reinforced epoxy resin which has an indentation and, where appropriate, comprises conductor tracks, including that for forming the antenna. The electronic chip is introduced into the indentation of the component layer. Subsequently, this entire component is inserted into an injection mold and, after the mold has been closed, a liquid, thermosetting polymer material is injected into it at low pressure and is cured therein. Specifically, a thermosetting epoxy resin is proposed for this purpose. The curing of the epoxy resin takes 4 to 5 minutes; after the molding has been removed from the mold, after-curing by heating at a certain temperature for a certain time is necessary - specific details of this aftercure are lacking.

EP-A-0 350 179 describes a production process for smart cards and similar electronic tokens with the aid of a reaction injection molding process. The electronic circuit is encapsulated by a layer formed by the reaction injection molding material. The cover films of the two flat sides of the card are supplied to the mold in the course of injection molding in such a way that they serve simultaneously as mold release agents for facilitating the removal of the cured card body from the injection mold. Specific details regarding the composition of the polymer for the reaction injection molding process are not given; all that is said is that it is possible to take any polymer material or any polymer blend that cures under reaction injection molding conditions. Owing to the precision metering

equipment they entail, reaction injection molding machines are known to be expensive and complicated.

EP-A-0 846 743 describes a thermoplastic, heat-curable, self-adhesive sheet for implanting electric modules into a card body which is provided with a cutout into which it is intended an electronic module should be arranged, said module having on the first side a plurality of contact areas and on the opposite side an IC chip whose contacts are connected by electrical leads to the contact areas. The adhesive sheet is to be composed of a thermoplastic polymer, one or more tackifying resins and/or epoxy resins with hardeners, and also accelerators, where appropriate. These adhesive sheets have to be heat-cured at approximately 150°C for 30 minutes.

JP-A-05 270 173 describes a process for producing laminated sheetlike polymer structures for blank card bodies. For this purpose, two rigid PVC sheets are coated with a film of a moisture-curing polyurethane hot-melt adhesive from 5 to 50 µm thick at from 100 to 120°C and are compressed for 10 seconds under a pressure of 5 kg/cm². One of these sheets has a cutout, or a cavity produced by thermoforming, intended to accommodate the microprocessor that is to be inserted subsequently. Thereafter, these sheetlike structures are left at room temperature for several hours without pressing, so that the adhesive cures to give a card base material which can be processed to the finished smart card in further processing steps.

An object of the invention was therefore to develop a gentle, quick and easy process for producing smart cards, permitting cost-effective large-scale manufacture of such smart cards.

The inventive achievement of the object is set out in the claims. It essentially comprises the use of thermoplastic hot-melt adhesives for producing the component layers of smart cards, and a process for producing said smart cards wherein the thermoplastic hot-melt adhesives can be used at low temperatures and low pressures in the low-pressure injection molding process.

As thermoplastic hot-melt adhesives it is preferred to use the low-melting polyamides based on polyaminoamides, thermoplastic polyurethanes or atactic polypropylene, or a blend thereof, to produce the component layer. These thermoplastic hot-melt adhesives feature a low viscosity of from about 100 to 100 000 mPa.s at the processing temperature. As a result, they can be used in the low-pressure injection molding process at pressures of between 1 and 50 bar, preferably at injection pressures of between 10 and 30 bar. The processing temperatures are guided by the composition of the hot-melt adhesive material; they are situated at between 80°C and 250°C, preferably between 100°C and 230°C. The polyamides to be used with preference generally have a viscosity of less than 10,000 mPa.s at 210°C. Particularly preferred ranges of the processing viscosities at 210°C are situated at between 1,500 and 4,000 mPa.s, this viscosity usually being measured using a Brookfield viscometer of the RVDV II type with Thermose facility.

In particular cases, reactive, moisture-postcrosslinking polyurethane hot-melt adhesives may be used instead of the aforementioned thermoplastic hot-melt adhesives. The moisture-reactive polyurethane hot-melt adhesives, although involving increased effort during application owing to their moisture sensitivity,

have an advantage which lies in the markedly lower viscosity at processing temperatures: reactive polyurethane hot-melt adhesives generally have viscosities at 130°C of < 25 000 mPa.s, preferably indeed below 15 000 mPa.s, and with very particular preference below 10 000 mPa.s at 130°C, the viscosity customarily being measuring using a Brookfield viscometer of the RVDV II type with Thermosel facility. An advantage of the use of moisture-curing polyurethane hot-melt adhesives is their low melting point, which is generally below 100°C, preferably below from 70 to 80°C, so that even very temperature-sensitive circuits may be embedded using these hot-melt adhesives and even very temperature-sensitive laminating films may be used. Their postcrosslinking with moisture results in the formation of a particularly resistant and temperature-stable bond between component layer and base film and cover film.

Through the use of the thermoplastic hot-melt adhesive to produce the component layer, the subsequent milling to produce the space require to accommodate the chip, or chip and antenna, becomes unnecessary, since these parts to be encapsulated may be placed in the corresponding encapsulation mold prior to the finishing of the base structure. During the subsequent encapsulation process, chip, or chip and antenna, are surrounded by the base body thus produced (component support) such that there is no longer any subsequent need either for additional fixing or for any cushioning or surround-filling of the electronic components. Moreover, when the printable or printed base film and cover film are applied, it is possible to forego additional application of adhesive to the component support, since the latter is of course itself

manufactured of adhesive and, following appropriate activation by heating if desired, forms a secure bond with the base films and/or cover films.

In accordance with the invention, all thermoplastic, reactive and nonreactive hot-melt adhesives may be used to produce the card base body, provided they can be processed at temperatures between 80°C and 250°C, preferably between 100°C and 230°C, in the low-pressure injection molding process, i.e., their processing viscosity should be situated at between 100 and 100 000 mPa.s. The pressure range for the low-pressure injection molding process is situated in the range from 10 to 30 bar, particular preference being given to a range for injection molding of between 10 and 30 bar. This ensures that the inserted chips or other electronic storage media used can be surrounded gently and not damaged and destroyed as in the regular injection molding process by means of high injection pressures (500 to > 1 000 bar).

Depending on the nature of the base film and cover film used for the finished card, and on the stiffness and elasticity requirements of the card body, and the possible temperature stresses thereon, the hot-melt adhesives may be selected from the conventional groups of polyamide (especially polyamidoamide based on dimerized fatty acids), polyurethane, polyesters, ethylene-vinyl acetate (EVA) copolymer, low molecular mass polyethylene copolymer, atactic polypropylene (APP), or combinations thereof. As already mentioned above, it may be advantageous in particular cases to use reactive hot-melt adhesives based on moisture-postcrosslinking polyurethanes instead of the aforementioned thermoplastic hot-melt adhesives.

As the base film and/or cover film it is possible here to use all films known in principle for this purpose; examples that may be mentioned include films based on polyester, especially polyethylene terephthalate (PET), polyvinyl chloride (PVC), acrylonitrile-butadiene-styrene (ABS), polycarbonate (PC) or polyimide. These films usually have thicknesses of up to 100 μm ; preferably, the film thicknesses are situated in the range between 30 and 70 μm .

In the production process of the invention, a variety of procedures can be adopted. Firstly, the chip and the associated antenna, where appropriate, may first be placed in the injection mold of the injection molding unit, it being possible for the chip and antenna to be in preassembled form on a support film, for example. After the mold has been closed, the hot-melt adhesive is then injected. After brief cooling, the mold can be opened and the component layer thus produced removed from the mold. No further application of adhesive is required for the subsequent lamination with a base film and/or cover film, since the matrix of the card body layer acts itself as an adhesive: all that need be done is to compress the films with the component layer, with heating where appropriate.

Alternatively, a thin film of the hot-melt adhesive may be placed in the injection mold, and the electronic component and the antenna placed thereon. Subsequently, the mold is closed and the electronic components are completely encapsulated by the injection of further hot-melt adhesive material. Again, no further application of adhesive is necessary for lamination with the base and/or cover film, since here again, with heating where appropriate, the films can be compressed with the component layer and so are

connected permanently to the layer. The film thickness of the hot-melt adhesive matrix including the encapsulated chip is presently in general between 400 and 600 μm , preferably 500 μm , but may turn out to be thinner or thicker depending on the type of chip.

For the embedding of the electronic component and the antenna into the matrix of the card support layer comprising the hot-melt adhesive, it is possible in one particularly preferred embodiment to use a low-pressure processing system from Optimel Schmelzgußtechnik. The preferred embodiment of the injection mold is depicted in figures 1 to 3. Of these figures, Fig. 1 shows a plan view of the bottom part of the injection mold, Fig. 2 shows a side view of the top part of the injection mold, Fig. 3 shows a detail of the top part.

In accordance with **Fig. 1**, the bottom part 1 of the injection mold possesses a cutout 2 whose length and width correspond to the dimensions of the top part of the injection mold. The bottom part of the injection mold further comprises the runner 3, which is designed so that the hot-melt adhesive is able to fill the entire mold, fully and without bubbles, within very short cycle times. Moreover, the shape of the runner is designed so that the sprue remaining on the card body can be removed easily after the card body has solidified.

Fig. 2 shows a cross-sectional view of the upper part 4 of the injection mold across the line A-B of Fig. 1. In its upper marginal region this top part has a projection 5, so that when the top part engages in the cutout 2 of the bottom part a fully closed chamber is formed in the injection mold. The cutout 6 of the

top part 4 corresponds in its length and width dimensions to the card support layer that is to be manufactured; the thickness of the cutout 6 corresponds to the thickness of the component layer that is to be manufactured.

Fig. 3 shows a detailed view C of Fig. 2, which shows in detail the cutout 6 for the card support layer.

Alternatively, in a continuous manufacturing process, the base film and cover layer film may be supplied to the injection mold simultaneously with the chip and, where appropriate, the antenna, which where appropriate may also have been applied in a copper foil on a thin flexible film. After the mold has been closed, the hot-melt adhesive is again injected. After brief cooling and opening of the mold, the finished layer body may be transported further. This procedure affords the advantage that the base layer and cover layer may be used simultaneously as mold release agents in the injection mold. In all of the aforementioned production processes, the base film and/or cover film may be provided in an upstream or downstream manufacturing step with customary information and/or advertising imprints and/or security features such as a photo of the cardholder, a magnetic strip, an identification symbol in the form of a hologram or the like.

The advantages of the use of thermoplastic hot-melt adhesives to produce the component layers, in accordance with the invention, relative to the prior art, are:

- There is no need for support material which has to be produced separately by normal injection molding process.
- Milling work to produce the cutouts for the chip and the antenna is unnecessary.
- Also unnecessary is the separate adhesive bonding of chip and antenna into the cutouts.
- Following lamination with base film and cover film there is no "readthrough" of the unevennesses from conventional manufacture, since the card support layer on the one hand possesses a very smooth surface and on the other hand itself acts as an adhesive.

Although the principal field of application of the invention is in the production of contactless cards comprising electronic circuits (smart cards), this technology may also be used to produce transponders for the vehicle industry, in mechanical engineering and in container construction for the control of operations.

What is claimed is:

1. The use of thermoplastic hot-melt adhesives to produce component layers of smart cards.
2. The use of thermoplastic hot-melt adhesives to produce transponders.
3. The use as claimed in claim 1 or 2, wherein the hot-melt adhesive has a composition based on polyamide, polyurethane, polyester, atactic polypropylene (APP), ethylene-vinyl acetate (EVA) copolymers, low molecular mass polyethylene copolymers, or blends thereof.
4. A process for producing card bodies comprising electronic circuits (smart cards), which comprises using as component layer material a thermoplastic hot-melt adhesive whose processing viscosity is situated between 100 and 100 000 mPa.s (Brookfield, RVDV II + Thermosel).
5. The process as claimed in claim 4, wherein the component layer is molded in the low-pressure injection molding process at pressures between 1 and 50 bar and processing temperatures between 80°C and 250°C, preferably between 100°C and 230°C.
6. A multilayer card body, wherein the layer carrying electronic circuits is composed of a thermoplastic hot-melt adhesive.

PCT

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INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE
INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) Internationale Patentklassifikation ⁷ : G06K 19/077, B29C 45/14, C09J 5/06		A1	(11) Internationale Veröffentlichungsnummer: WO 00/25264
			(43) Internationales Veröffentlichungsdatum: 4. Mai 2000 (04.05.00)
(21) Internationales Aktenzeichen: PCT/EP99/07683		(81) Bestimmungsstaaten: CA, JP, KR, US, europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) Internationales Anmeldedatum: 13. Oktober 1999 (13.10.99)			
(30) Prioritätsdaten: 198 48 712.6 22. Oktober 1998 (22.10.98) DE		Veröffentlicht <i>Mit internationalem Recherchenbericht. Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist; Veröffentlichung wird wiederholt falls Änderungen eintreffen.</i>	
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(54) Title: HOT-MELT ADHESIVE COMPONENT LAYERS FOR SMART CARDS			
(54) Bezeichnung: KOMPONENTENSCHICHT FÜR SMART CARDS AUS SCHMELZKLEBSTOFFEN			
(57) Abstract			
<p>The invention relates to the utilization of thermoplastic hot melt adhesives for the production of component layers in smart cards or for the production of electronic transponders with the aid of a low pressure injection molding process at pressures ranging between 1 and 50 bar. Preferably, hot melt adhesives based on polyamide, polyurethane, polyester, atactic polypropylene, EVA copolymers or low molecular weight ethylene copolymers or the mixtures thereof are used in said method.</p>			
(57) Zusammenfassung			
<p>Es wird die Verwendung von thermoplastischen Schmelzklebstoffen zur Herstellung von Komponentenschichten in Smart Cards oder zur Herstellung von elektronischen Transpondern mit Hilfe eines Niederdruck-Spritzgußverfahrens bei Drücken zwischen 1 und 50 bar beschrieben. Vorzugsweise finden für dieses Verfahren Schmelzklebstoffe auf der Basis von Polyamid, Polyurethan, Polyester, ataktischem Polypropylen, EVA-Copolymeren oder niedermolekularen Ethylen-Copolymeren oder deren Mischungen Verwendung.</p>			

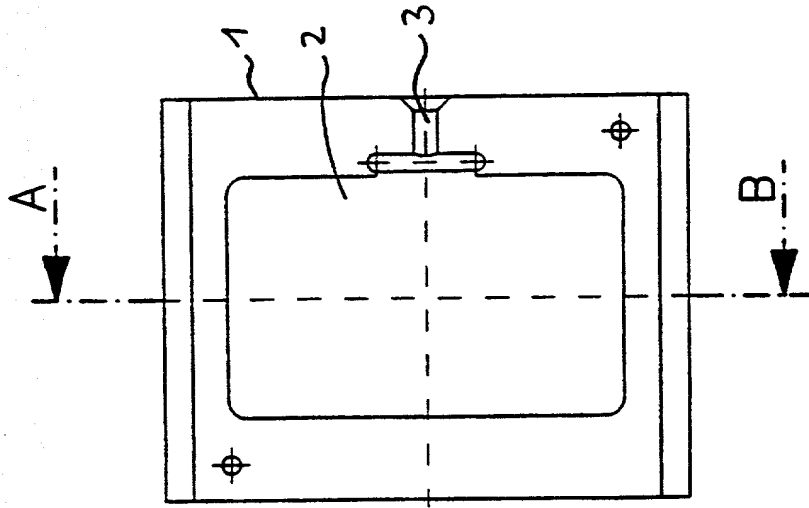


Fig. 1

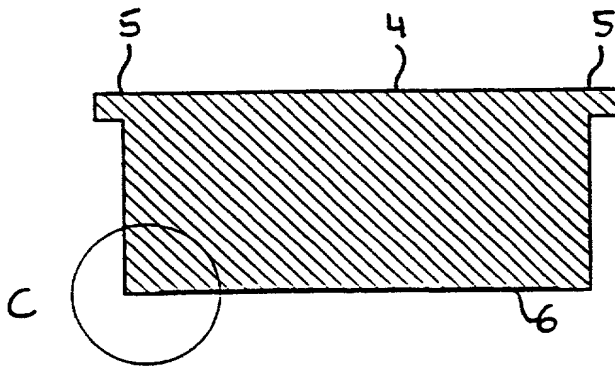


Fig. 2

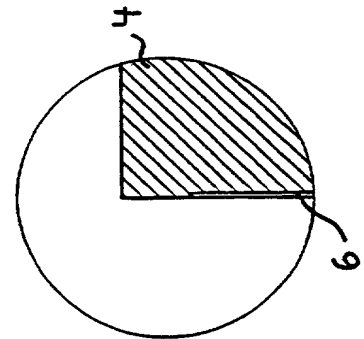


Fig. 3

13 Rec'd PCT/PTO 22 APR 2002
09/807948

"Express Mail" mailing label number EL 615775233US.

PATENT

Docket No. H 3516 PCT/US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: **Application of**
 Ranft, et al.

International Appl. No. PCT/EP99/07683
International Filing Date: October 13, 1999

Serial No. 09/807,948

Examiner: To be assigned

Filed: To be assigned

Art Unit: To be assigned

Title: HOT-MELT ADHESIVE COMPONENT LAYERS FOR SMART CARDS

DECLARATION OF LIANE MEUTEN

I, Liane Meuten, nee Liane Wuestrich, an inventor in PCT Application No. PCT/EP99/07683, declare the following:

1. When the above-identified PCT Application was filed, I was unmarried and used my maiden name, Liane Wuestrich;
2. On the 31 day of August, I was married to Theodor Meuten and began using my husband's family name; and
3. Liane Wuestrich and Liane Meuten are the same person.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Liane Meuten
Liane Meuten

Liane Wuestrich
Liane Wuestrich

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

☐ Declaration Submitted with Initial Filing OR ☒ Declaration Submitted after Initial Filing

Attorney Docket
Number

H 3516 PCT/US

First Named
Inventor

Ranft, Paul

COMPLETE IF KNOWN

Application Number

Filing Date

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

HOT-MELT ADHESIVE COMPONENT LAYERS FOR SMART CARDS

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 10/13/1999 as United States Application Number or PCT International

Application Number PCT/EP99/07683 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority		Certified Copy Attached?	
			Not Claimed	YES	NO	
198 48 712.6	Germany	10/22/1998	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.
		<input type="checkbox"/>

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DECLARATION

Page 2

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365© of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code §112.1 acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
	PCT/EP99/07683 ✓	10/13/1999 ✓	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

<input type="checkbox"/> Firm Name		Customer Number	or label	
OR				

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Country	<u>USA</u>	Telephone	<u>610-278-4964</u>	Fax	<u>610-278-6548</u>

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's Signature					Date		
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						Applicant Authority	
<input checked="" type="checkbox"/> Additional inventors are being named on supplemental sheet(s) attached hereto							

Type a plus sign (+) inside this box → ☐

H 3516 PCT/US

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Supplemental Sheet

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☐ A petition has been filed for this unsigned inventor

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Inventor's Signature Date

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